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V.—CONTRIBUTIONS TOWARDS A PHYLOGENETIC CLASSIFICATION OF FLOWERING PLANTS. I.

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Mr. Hutchinson has devoted much of his leisure time during the past few years to a careful study of the genera and species of the more primitive groups of archichlamydeous (polypetalous) families of flowering plants.

This very valuable piece of work has been undertaken with the object of preparing a phylogenetic system of classification of natural families and genera, and it is intended in due course to publish the full results of these studies as a separate work.

Since it is very desirable to make known some of the conclusions already reached by the author, it will be convenient to publish occasional papers in the *Bulletin*, and the present contribution represents the first instalment.

These contributions will provide keys to the larger families and include all the described genera arranged, as far as may be possible, on the basis of their probable phylogeny.

The general principles governing this phylogenetic sequence are explained on p. 73.

Mr. Hutchinson has already published two papers which properly belong to the series in contemplation, namely, The Winteraceae (*Kew Bull.* 1921, 185–191), and The Genera of Fumariaceae and their Distribution (*Kew Bull.* 1921, 97–115), and also a joint paper with the late Mr. J. R. Drummond on Isopyrum and Allied Genera (*Kew Bull.* 1920, 145–169).—A. W. H.

Perhaps no subject is of more general interest to botanists of the present decade than the problem of the early race-history or phylogeny of plant life, and during recent years, especially, of flowering or seed-plants. The study of phylogeny, combined with that of the past and present distribution of plants, furnishes important evidence in regard to the question of former land connections between areas now separated by wide oceans, a subject which has repeatedly attracted the attention of biologists. Especially is this the case where marked similarity in the floras of far distant regions is clearly evident, such, for example, as

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(1) the Eastern United States and Eastern Asia, (2) the flora of the West African rain forest with that of the eastern coast of Brazil, (3) the Mascarene flora and that of Southern India, (4) the South African and West Australian floras, (5) the New Zealand and South West American floras, and nearer home (6) the South West British and Lusitanian floras.

Whether these areas were at one time connected by intervening land bridges, where now are deep oceans, or whether they were actually once contiguous areas which have now become separated will for long remain a debatable question. Certainly the comparatively new theory* of the origin of continents, *i.e.*, by displacement and gradual divergence one from another, would easily explain many of the problems of plant distribution. Though this subject cannot be fully dealt with here, it seems significant that with few exceptions these floral affinities of distant areas are entirely in an east and west direction and hardly ever north and south. I disregard for the moment the supposed affinity between the Mediterranean and South African floras which may be due to parallel evolution in the two hemispheres.

The distribution of the filmy fern, *Hymenophyllum ferrugineum*, of Juan Fernandez, Chile and New Zealand, cannot easily be explained otherwise than by a former land connection, especially when we consider also the distribution† of *Galaxias attenuata*, a fresh-water fish, which occurs in South East Australia, Tasmania, New Zealand and subantarctic South America. I merely quote these examples from among a multitude of others to show that the phylogeny of plants is intimately connected with many interesting biological problems and should not be neglected, and a phylogenetic system of classification should be the ultimate aim of taxonomy. In fact the description of every new genus, every new species or form of plant may be regarded as a contribution towards this end.

Systems of classification.

The number of systems of classification is now very considerable. For an excellent account of the earlier systems the reader is referred to Lindley's "Vegetable Kingdom" (introduction), and for later schemes to Rendle's "Classification of Flowering Plants" (vol. 1, Historical Introduction). Since Lindley's time, however, only two great treatises have appeared which have commanded universal attention, namely, the "Genera Plantarum" of Bentham and Hooker, published in 1862–1883, which elaborated the De Candolle System, and the "Natürliche Pflanzenfamilien" of Engler and Prantl (1887–1909). From a phylogenetic standpoint both these works have been subjected to a considerable amount of criticism, especially that of Bentham and Hooker.

* See A. Wegener, "The Origin of Continents and Oceans," in Discovery III., 114–118, figs. 1–3 (1922).

† See Cockayne "The Vegetation of New Zealand," in Engl. & Drude, "Die Veg. der Erde," 14: 326 (1921).

And in recent years the Engler System has been assailed by certain North American* and British† botanists who have devoted special attention to the subject. Opinion in America in particular seems to have changed rapidly from an almost universal acceptance of the German system towards a modification of the arrangement of Bentham and Hooker which they had nearly abandoned. This criticism refers especially to the question of the relative primitiveness of the various groups from which a start should be made, such, for instance, as the position of the "Amentiferae" and other apetalous groups, and of the Monocotyledons.

Bentham & Hooker's Genera Plantarum.—The system of Bentham & Hooker was probably never intended to express a complete phylogenetic scheme of classification, for it is but a more extended arrangement of Jussieu's work elaborated as long ago as 1789, and further expounded by De Candolle in 1818, when botanists were still imbued with the idea of the fixity of species, and long before they had the aid of the Darwinian theory of descent as their guide.

Perhaps Jussieu should be reckoned, second only to Linnaeus in that he was the first botanist to co-ordinate the genera of plants into families more or less as we now know them. Although a few of the names of his groups are unfamiliar to present-day botanists, nearly all in a slightly modified form are still in use. Bentham & Hooker's work was primarily concerned with a practical handbook to the genera of plants arranged in such a manner as best to facilitate their determination. For the moment, however, we may assume that Bentham & Hooker's Genera Plantarum was intended to express a more or less natural system, and examine the arrangement of their main groups. They began with the *Polypetalae*, their first Order (Cohort) being the *Ranales* composed of the well known *Ranunculaceae* and allied families, characterised by apocarpy and hypogyny of the flower. From these they proceeded to a discifloral series and finally (in the *Polypetalae*) to the calycifloral perigynous and epigynous types of flower. After these the *Gamopetalae* were enumerated, then the *Monochlamydeae* (*Apetalae*) and *Gymnosperms*, and finally the *Monocotyledons*. In elaborating their system, if we may continue to call it such, they unfortunately retained the *Monochlamydeae* as a group apart from the *Polypetalae*, and it is to this point and also to the anomalous position of the Gymnosperms that most criticism has been directed in the past. I use the word retained, for those distinguished authors were well aware of the true affinities of the families which compose these two unnatural groups. This is clearly seen by reference

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* See especially C. E. Bessey "The phylogeny and taxonomy of Angiosperms" Bot. Gaz. 24 : 145–178 (1897), and Ann. Missouri Bot. Gard. 2 : 109–164 (1915).

† E. A. N. Arber & J. Parkin, "The Origin of Angiosperms," Journ. Linn. Soc. Bot. 38 : 29 (1907).

to their notes on relationships at the end of each family description. Take, for example, the notes* accompanying *Illecebraceae* (vol. III. p. 2.) and other families of *Monochlamydeae* :—" Ordo *Amarantaceis* certissime affinis sed stipulis, perianthio herbaceo staminibusque perigynis differt. *Caryophylleae* distinguuntur floribus petaliferis ovario pluriovulato, fructuque capsulari; *Portulaceae* sepalis 2, corolla, capsulaeque dehiscentia. *Ficoideae* connexae sunt ope *Adenogrammatis* cui ovarium 1-loculare ovulo basilari. . . . Tribus *Sclerantheae*rum transitum ad *Caryophylleas* demonstrat. *Ficoidearum* tribus *Mollugineae* differt ovario polycarpico et staminibus saepissime hypogynis." Again, under *Monimiaceae*, we read " Ordo biformis sed bene naturalis, a pluribus botanicis *Anonaceis* approximatur ob gynaecium apocarpicum et embryonem saepius minimum, sed perianthio calycino apetalo albumine aequabili aliisque notis essentialibus longiuscule recedit. . . ." Then under *Lauraceae*, *Loranthaceae*, *Santalaceae*, *Euphorbiaceae*, *Platanaceae* and *Juglandaceae* we find similar notes of affinity with polypetalous families, and many of these suggestions were embodied by Engler & Prantl in their System.

The System of Engler & Prantl.—The chief difference between this system and that of Bentham & Hooker is the amalgamation of Jussieu's groups *Polypetalae* and *Monochlamydeae* under the single group *Archichlamydeae* and in the Monocotyledons taking precedence of the Dicotyledons. But in Engler's *Archichlamydeae* those apetalous families composing the so-called group *Amentiferae* or catkin bearers (*Betulaceae*, etc.) are regarded as being the most primitive and precede such primitive petaliferous families as *Ranunculaceae* and *Magnoliaceae*. †Bessey has shown in his comparison of the palaeontological researches of Schimper and Lesquereux, that in the Cretaceous period in North America, when the dicotyledonous flora is first recorded, there was actually a preponderance of petaliferous " Polypetalae." Bessey contends, therefore, and many botanists will agree with him, that polypetaly was earlier and that one of the first modifications of it was probably in the direction of apetaly, a condition reached by many plants in the earlier periods but by relatively smaller numbers at the present day.

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* For the convenience of students who may not be familiar with botanical latin I give the following translation of the above passage: " The family *Illecebraceae* is very closely allied to the *Amarantaceae*, but differs by having stipules, a herbaceous perianth and perigynous stamens. The *Caryophyllaceae* are distinguished by their petaliferous flowers, many ovuled ovary and capsular fruit; *Portulaceae* by their geminate sepals, by their corolla, and dehiscent capsule. The *Ficoideae* are connected through the genus *Adenogramma* which has a 1-celled ovary and basal ovule. The tribe *Sclerantheae* shows a transition to the *Caryophyllaceae*. The tribe *Mollugineae* of *Ficoideae* differs by its polycarpic ovary and very often hypogynous stamens.

† Bessey, Bot. Gaz. 24: 151 (1897).

C. Robertson* has ably discussed the question of the primitive or non-primitive character of the "Amentiferae" group of *Apetalae*, on which the acceptance of Engler's views so much depends. He offers the theory that primitive Angiosperms were already entomophilous and that anemophilous types are metamorphosed entomophilous flowers resulting from reduction and degradation, and are not at all primitive. Probably too much importance has been attributed to the anemophily of the *Amentiferae*, on the false analogy of the *Gymnosperms*.

Regarding the origin of *Ranunculaceae* and allied families, after a careful examination of these groups, I find myself unable to accept Hallier's view† that the *Ranunculaceae* and *Nymphaeaceae* have descended from the *Magnoliaceae* through the *Schizandraceae*, *Lardizabalaceae* and *Berberidaceae*. It is a far cry indeed from a Buttercup to a Magnolia. To my mind the floral structure of *Berberidaceae* and *Lardizabalaceae* suggests evolution in entirely the opposite direction, *i.e.*, from the *Ranunculaceae*. There are many connecting links between the *Ranunculaceae* and the *Berberidaceae*, and the latter appear to be the reduced and more recent forms. The relative antiquity of woody and herbaceous plants has been the subject of a most interesting and instructive paper by Sinnott and Bailey,‡ whose researches go to show that in the flowering plants herbs, as a rule, have been derived from woody plants. However probable this may be, I do not think it can account for the origin of *Ranunculaceae* from any existing woody group. That herbs have been derived from ligneous types in certain families seems clear from some of the examples they quote, but it seems to me that the theory should be applied with considerable caution, for it is reasonable to suppose that the reverse may have frequently occurred, and that an herbaceous group may have evolved woody or semiwoody types. The study of this subject from both standpoints would no doubt be productive of interesting results. The type of wood peculiar to *Clematis*, *Berberis* and the *Menispermaceae* generally, may owe its peculiarity to derivation from *herbaceous* ancestors. From a consideration of floral structure and wide distribution the genus *Clematis* with its woody habit, opposite leaves, its induplicate-valvate sepals and apetalous condition, in conjunction with this view regarding the origin of woody structure, may be traced back through the intermediate genus *Clematopsis* (*Kew Bull.* 1920, 12–22) to the herbaceous and more primitive genus *Anemone*, by way of *Anemone* §*Pulsatilla*. There are wide gaps in the relationships of the

* C. Robertson, The Structure of the Flowers and the Mode of Pollination of the Primitive Angiosperms: Bot. Gaz. 37: 294–298 (1904).

† H. Hallier, "Provisional Scheme of the Natural (Phylogenetic) System of Flowering Plants," in New Phytologist, 4: 151–162 (1905); see especially p. 157.

‡ E. W. Sinnott & I. W. Bailey, "The Origin and Dispersal of Herbaceous Angiosperms," in Ann. Bot. 28: 547–600 (1914).

genera of *Berberidaceae*, but the genus *Berberis* may perhaps similarly be traced through *Mahonia*, and some lost type of plant related to *Epimedium*, which is itself a highly evolved member of the family. And similar reasoning may be put forward regarding the origin of the *Menispermaceae* and *Aristolochiaceae*, where in the case of the latter family complete reduction of the inner perianth has been carried out, as in *Clematis*. It is significant that the production of peculiar woody structure in these groups should be accompanied by reduction and degradation of the flowers.

Considerations for the delimitation of groups of families.

With the exception of the primary division into Dicotyledons and Monocotyledons, large groups are usually artificial, especially if the characteristic fixed upon to distinguish them is a general tendency and founded on a single character. Examples are the De Candollean artificial groups *Thalamiflorae*, *Disciflorae*, *Calyciflorae*, *Inferae* and to a less extent the *Parietales*, *Centrospermae* and *Amentiferae*. The special characteristics indicated by the names of some of these groups are general tendencies in many families of flowering plants. Although it is still very convenient to recognise two main groups of Dicotyledons as *Archichlamydeae* and *Metachlamydeae* (*Polypetalae* and *Gamopetalae*), a true phylogenetic classification would be better attained in which the gamopetalous character were regarded in its true light, *i.e.*, as a general tendency, for gamopetaly is quite a common feature in many so-called polypetalous families.* It is perhaps too early to suggest so revolutionary a change. The result, however, would be the closer approximation of such clearly related families as the *Anonaceae* and *Sapotaceae*, *Caryophyllaceae*, *Primulaceae* and *Gentianaceae*, the *Rhamnaceae* and *Myrsinaceae*, etc. In a new classification, therefore, smaller groups must be recognised, which are bound together by a combination of characters, and which allow the introduction of the general tendencies of floral development such, at any rate, as perigyny, epigyny and apetaly. For this reason I have proposed (*Kew Bull.* 1921, 185–191) the establishment of the order *Magnoliales* as distinct from *Ranales*, because I consider that they may have been evolved from separate primitive stocks developed on parallel lines, *i.e.*, with strobilus-like hypogynous polycarpellary flowers. The ultimate development of the more primitive families of these two groups, the *Magnoliaceae* and *Ranunculaceae* respectively, is entirely dissimilar, the one remaining entirely arboreal, the other mainly herbaceous. I am not sure that a third primitive group should not be recognised, say the *Dilleniales*, whence might be traced the *Ternstroemiales* and the vast domain of *Rosales* and " Amentiferae."

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* For example *Anonaceae*, *Meliaceae*, etc.

These are considerations, however, which may be better dealt with at the conclusion of our studies in order to avoid the error of making the facts fit the theory, a common tendency of modern times.

Considerations for the delimitation of families.

A great divergence of opinion is evident in the two principal systems of classification in regard to the delimitation of families. Thus the number of families of flowering plants, including the Gymnosperms, in the Genera Plantarum is 200, in the Pflanzenfamilien 280, whilst the number is further increased in Engler and Gilg's Syllabus. There is much to be said in favour of reducing the size of families wherever reasonably possible, and I am in favour of going slightly further even than Engler. For instance, to include in the *Magnoliaceae* such distinct families as the *Winteraceae*, *Schizandraceae*, *Trochodendraceae*, *Himantandraceae*, and *Cercidiphyllaceae*, is decidedly incongruous. If these latter families are excluded the *Magnoliaceae* proper is a homogeneous group, the characters of which are easily grasped. A similar argument may be advanced for the segregation of *Papaveraceae* and *Fumariaceae*, the *Guttiferae*, *Quiinaceae* and *Eucryphiaceae*, the *Ternstroemiaceae*, *Marcgraviaceae* and *Caryocaraceae*, and many other families, even the *Leguminosae* into the *Mimosaceae*, *Caesalpiniaceae* and *Papilionaceae* (*Fabaceae*). On the other hand I should consider it going too far to divide the *Compositae* into the *Asteraceae*, *Vernoniaceae*, *Eupatoriaceae*, etc., whilst the wisdom of separating the *Rosaceae* into several families is rather doubtful. All this goes to prove that the delimitation of families, of genera, and of species is very much a matter of taste and personal idiosyncrasy. And it is on this account that the work of Bentham & Hooker carries perhaps more weight from being the production of a single pair of minds, than that of Engler & Prantl, who enlisted the services of a large number of botanists to carry out the work, resulting in a great diversity of treatment, especially as regards the genera.

Considerations for the delimitation of genera.

The delimitation of genera is also very much a matter of taste and personal opinion, even more so than in the case of species. Sometimes the differences between certain genera of a family are not of a very pronounced type, whilst other groups more easily distinguished are treated as sections of one genus. No hard and fast rule for distinguishing genera is possible. For instance, many reduced to synonymy by Bentham and Hooker have been restored to generic rank, often for very good reasons. The genus *Mahonia* is now generally recognised as being quite distinct from *Berberis*, to quote a familiar example. The present writer has restored the genus *Plagiorhegma*, from Manchuria

(see *Kew Bull.* 1920, 242), because it is as distinct from *Jeffersonia* (N. America) as any other two genera of *Berberidaceae* are from each other. The restoration or amalgamation of genera, however, should as a rule not be attempted unless an author has made a thorough study of the whole group or family to which they belong. Authors of small local floras often attempt to split up genera, because in the particular area dealt with they appear to be easily separable. Thus in the Flora of Gibraltar (Journ. Bot. 1914, suppl. 56) several species are separated from *Chrysanthemum* as genera which are scarcely distinguishable even as sections. A study of the world species of the genus *Chrysanthemum* would have shown these genera to be untenable. From our point of view Small's otherwise most excellent Flora of the South-Eastern United States suffers from an excessive segregation of genera, often distinguished on trifling characters. On the whole, however, botanical science in respect of genera suffers less than most other branches of natural history. If one may pick out amongst many others a good example of a local flora one might select Cheeseman's well known Flora of New Zealand, a book which in regard to its genera conforms to standard works.

There is a good example of the above question in the family *Ranunculaceae*. In regard to the limits of the genus *Anemone*, there has been no agreement amongst authors. I think there is a good case for recognising *Hepatica* as a separate genus (*cf.* key on p. 85) and I have accepted the South American segregates which have been the subject of a paper by Britton (see p. 88), *i.e.*, *Capethia*, which has no involucre, *Barneoudia*, with a remarkable fleshy cyathium-like involucre close up to the flower, and the North American *Syndesmon*, with long-petiolate leaves each of which subtends a flower. After a careful examination of all the species, however, I find myself unable to uphold *Pulsatilla* as a separate genus. Britton (l.c.) says in regard to this question :—"There is perhaps less reason for keeping *Anemone* and *Pulsatilla* distinct than for separating *Hepatica*, but I find no transitions from *Pulsatilla* to *Anemone*, and it forms a very natural group of species both as to structure, habit, and geographical distribution throughout the North temperate zone." Amongst the old-world species, however, there are intermediate species. The well known garden plant, *A. hortensis*, has a short style, *A. palmata* a style 4–5 mm. long, as has also *A. glaucifolia ;* but it is in the African species that the best intermediate examples occur. In *A. Thomsonii*, a high mountain species from East Tropical Africa (9000–13000 ft.), the style is not that of § *Pulsatilla*, but the involucre is pectinate as in that section, whilst *A. capensis* shows the reverse, *i.e.*, a long style and a normal leafy involucre; the latter characteristics are also shown by *A. Fanninii*, Harv., a Natal species.

I give below the general principles of classification which I have adopted in arranging the genera of plants in each family.

As Bessey* says they are generally accepted principles as applied to flowering plants, at any rate with those who believe that petaliferous plants preceded apetalous ones and that the latter have arisen through reduction.

*General principles adopted for the classification of flowering plants.

Other things being equal, it may be stated that :—

(1) Evolution is both upwards and downwards, the latter involving degradation and degeneration; examples: —the apetalous state of many flowers; unisexuality in flowering plants.

(2) Evolution does not necessarily involve all organs of the plant at the same time, and one organ or set of organs may be advancing whilst another set is stationary or retrograding.

(3) Evolution has generally been consistent, and when a particular progression or retrogression has set in it is persisted in to the end of the phylum; examples:— the strong tendency to zygomorphy of the corolla coupled with the reduction in the number of stamens in the hypogynous *Metachlamydeae;* the great tendency to perigyny and epigyny in the *Archichlamydeae* and *Metachlamydeae,* as exhibited in the families *Umbelliferae* and *Rubiaceae* respectively.

Relating to the general habit of plants.

(4) In certain groups, trees and shrubs are probably more primitive than herbs; examples, *Mimosaceae* and *Caesalpiniaceae* (trees and shrubs) as compared with the derived family *Papilionaceae* (*Fabaceae*) (mostly herbaceous).

(5) Trees and shrubs are older than climbers, the latter habit having been acquired through particular environment.

(6) Perennials are older than biennials, and from them annuals have been derived; note the extraordinarily few annuals in the primitive family *Ranunculaceae;* the great number in the *Cruciferae.*

(7) Aquatic Phanerogams are as a rule more recent than terrestrial (at any rate in the members of the same family or genus), and the same may be said of epiphytes, saprophytes, and parasites.

Relating to the general structure of flowering plants.

(8) Plants with collateral vascular bundles arranged in a cylinder (Dicotyledons) are more primitive in origin

* The reader is referred here to a second essay by Bessey, "Phylogenetic Taxonomy," published in the Annals of the Missouri Botanic Garden, vol. 2: 112. The present writer cannot accept all Bessey's generalisations, but his principles are given above together with a few additional observations.

than those with scattered bundles (Monocotyledons), though it does not necessarily follow that the latter have been directly derived from the former.

(9) The spiral arrangement of leaves on the stem and of the floral leaves precedes that of the opposite or whorled type.

(10) As a rule simple leaves precede compound leaves.

Relating to the flowers and fruits of plants.

(11) Bisexual (hermaphrodite) preceded unisexual flowers, and the dioecious is probably more recent than the monoecious condition.

(12) The solitary flower is more primitive than the inflorescence, the highest forms of the latter being the umbel and capitulum :—examples of the latter, *Umbelliferae, Compositae.*

(13) Spirally arranged floral parts are more primitive than whorled and valvate : examples *Ranunculus* and *Clematis.*

(14) Many-parted flowers (polymerous) precede, and the type with few parts (oligomerous) follows from it, being accompanied by a progressive sterilization of reproductive parts (sporophylls).

(15) Petaliferous flowers precede apetalous ones, the latter being the result of reduction.

(16) Free petals (polypetaly) are more primitive than connate petals (gamopetaly).

(17) Actinomorphy (regularity) of the flower is an earlier type than zygomorphy (irregularity) ; examples *Caltha* and *Delphinium.*

(18) Hypogyny is the primitive structure and from it perigyny and epigyny were derived later.

(19) Free carpels (apocarpy) are more primitive and from them connate carpels resulted ; sometimes however, when the carpels have remained loosely united during evolution they may again become quite free.

(20) Many carpels (polycarpy) preceded few carpels (oligocarpy) ; examples *Ranunculus* and *Nigella.*

(21) The endospermic seed with small embryo is primitive and the non-endospermic seed higher :—examples *Ranunculaceae* and *Rosaceae.*

(22) In the primitive flowers there are many stamens, in the higher flowers few stamens :—*Ranunculus* and *Cheiranthus.* This condition may, however, be reversed in response to the needs of insect life within the confines of a single family like *Papaveraceae,* where bees feed on the pollen.

(23) Separate stamens preceded connate stamens ; examples *Campanulaceae* and *Lobeliaceae.*

(24) Aggregate fruits are more recent than single fruits and as a rule the capsule precedes the drupe or berry.

The genera of Ranunculaceae.

I give here a brief outline of the classifications of the genera of *Ranunculaceae* by the principal systematists of the last century.

Jussieu 1789. Jussieu (Genera Plantarum, 231) divided the 24 genera of *Ranunculaceae* into four groups.

I. Fruits 1-seeded, indehiscent.

II. Fruits several-seeded, dehiscent on the inside. Petals irregular.

III. Fruits several-seeded, dehiscent on the inside. Petals regular.

IV. Ovary one. Berry 1-celled, many-seeded.

In his first group we find the genera *Clematis*, *Atragene*, *Thalictrum*, *Hydrastis*, *Anemone*, *Hamadryas*, *Adonis*, *Ranunculus*, *Ficaria*, *Myosurus*.

In the second group :—*Trollius*, *Helleborus*, *Isopyrum*, *Nigella*, *Garidella*, *Aquilegia*, *Delphinium*, *Aconitum*.

In the third group :—*Caltha*, *Paeonia*, *Xanthorrhiza*, *Cimicifuga*.

In the fourth group :—*Actaea* and *Podophyllum*.

From this list it is clear that Jussieu had a very good idea indeed of classification. His term "irregular" in regard to petals, however, was not strictly applied to the zygomorphic flower as we recognise it at the present day, for it included the actinomorphic flowered *Trollius*, *Helleborous*, *Isopyrum*, *Nigella*, *Garidella* and *Aquilegia*, as well as the truly zygomorphic flowered genera *Delphinium* and *Aconitum*.

Jussieu's fourth group need not be considered here, *Podophyllum* being now assigned to the *Berberidaceae*.

De Candolle 1818. De Candolle (Systema Naturale 1. 127) arranged the family into two main groups.

I. *Ranunculaceae Verae*. II. *Ranunculaceae Spuriae*. Group I. was divided into four tribes more or less as we know them to-day :—

1. *Clematideae ;* 2. *Anemoneae ;* 3. *Ranunculeae ;* 4. *Helleboreae*. His "spurious" *Ranunculaceae* were *Actaea*, *Xanthorrhiza*, and *Paeonia*. This classification was adhered to in his Prodromus (i. 2. (1824)) except that the "spurious" genera were included in a fifth tribe, *Paeoniaceae*, with a remark as to whether it should not constitute a distinct family. It is interesting to note that already in 1824 there were known 90 species of *Clematis*, 52 species of *Thalictrum*, 49 species of *Anemone*, 159 species of *Ranunculus*, 53 species of *Delphinium* and 22 species of *Aconitum*. At that time the number of species known for these genera totalled 425, and Bentham & Hooker's estimate 44 years later added only 13 more. The estimate for these genera in the present paper is 1290 species, which shows a great increase in our knowledge during recent years.

Endlicher 1839. Endlicher (Genera Plantarum 843) followed closely De Candolle's classification of the family, recognising a number of small genera, and remarking on the artificiality of the tribe *Paeonieae*, which he rather increased by the inclusion of *Trautvetteria*.

Bentham & Hooker 1862. Bentham & Hooker (Genera Plantarum i. 1) adhered closely to the arrangement of De Candolle. They placed the so-called spurious genera *Actaea* and *Xanthorrhiza* in the subtribe *Cimicifugeae* of the tribe *Helleboreae* and wisely limited *Paeonieae* to the genus *Paeonia*.

Baillon 1867. Baillon (Histoire des plantes i. 1.) classified *Ranunculaceae* in four tribes I. *Aquilegieae*, II. *Ranunculeae*, III. *Clematideae*, IV. *Paeonieae*, beginning with the genus *Aquilegia* and ending with *Crossosoma*, the latter now being regarded as a distinct family, the *Crossosomataceae*, more closely related to the *Dilleniaceae* and *Rosaceae*.

Prantl 1888. Prantl (Engler & Prantl, Natürl. Pflanzenf. iii. 2 : 54) divided the family into three main tribes, I. *Paeonieae*, II. *Helleboreae*, III. *Anemoneae*.

By over-emphasizing the importance of the relative lengths of the outer and inner seed coats, he associated in the tribe *Paeonieae* such divergent genera as *Glaucidium*, *Hydrastis* and *Paeonia*, thus rendering the tribe a most unnatural one. Another character used by Prantl for further subdividing his tribes into groups, namely, the presence of one or two integuments in the ovule, led to further artificiality, such genera as *Thalictrum* and *Adonis* being associated by this character alone. Further, Prantl's reductions of several distinct and well-defined genera such as *Knowltonia* to *Anemone*, *Naravelia* to *Clematis*, and *Cimicifuga* to *Actaea*, have not been generally accepted.

From our point of view there is little evidence of a phylogenetic arrangement in any of the above classifications, De Candolle's system beginning with the highly evolved and reduced genus *Clematis*, and Baillon's with the highly specialized genus *Aquilegia*. There appear to be two distinct phylogenetic groups in the family which for convenience may well be regarded as subfamilies. Of these the structure of the flowers of the *Helleboroideae*, and especially in regard to its gynaecium, is probably the more ancient, the often green leaf-like carpels corresponding to our conception of a primitive type. In this subfamily there is a remarkable range in floral structure from an apparently primitive genus such as *Helleborus* to a so highly evolved and specialized zygomorphic type of flower as is found in *Aconitum* and *Delphinium*. The best position for the *Paeonieae* remains a problem. I consider it to be an isolated type and have placed it first, as it shows no clear connection between the two other tribes. The second subfamily, *Ranunculoideae* with its achenial

1-seeded carpels, may, it is suggested, have been derived from the *Helleboroideae ;* or more likely it may have had a separate origin from some (at present) unknown group. At any rate the *Helleboroideae* approaches the *Ranunculoideae* closely in the neighbourhood of the genera *Isopyrum* and *Enemion*, wherein the ovules are sometimes reduced to a very small number. Below is given a diagram showing the approximate relationships of the principal groups and linking genera of the family *Ranunculaceae.*

Bentham & Hooker's classification began with the genus *Clematis* and ended with *Paeonia.* We now reverse this arrangement. Tribes *Paeonieae, Helleboreae* and *Clematideae* remain more or less as defined by Bentham & Hooker. As noted above, Prantl (Engler & Prantl, Pflanzenfamilien, iii. ii. 54) included the genera *Glaucidium* and *Hydrastis* in the tribe *Paeonieae*, determined mainly on characters derived from the relative lengths of the outer and inner seed coats. I think this feature has been much over-emphasized and in this case has led to an unnatural collection of very different types. *Paeonieae* is therefore treated here as being generically monotypic. Worsdell,* mainly on anatomical grounds, considers it to be worthy of taking family rank. From a taxonomic point of view, however, I think this is scarcely practicable. For similar reasons Engler's removal of *Hydrastis* to *Berberidaceae* is not acceptable. Its numerous carpels and longitudinally dehiscent anthers seem to destroy entirely the homogeneity of that family (I exclude from *Berberidaceae* the *Lardizabalaceae*) and it is much better placed in the *Ranunculaceae*, to which most previous authorities have referred it. I have ventured to recast tribes *Ranunculeae* and *Anemoneae*, separated by Bentham & Hooker on the position of the ovule and merged by Prantl into one tribe, on more natural lines, determined by the absence or presence of the involucre of leaves below the flower, so constant a characteristic (associated with apetaly) of the large and natural genus *Anemone.* For this reason the genera *Thalictrum, Knowltonia, Adonis, Callianthemum* and *Myosurus* are transferred from *Anemoneae* to *Ranunculeae*, to which they seem more closely related by characters other than the position of the ovule. The genus *Syndesmon* links these two tribes just as *Clematopsis* (*Kew Bull.* 1920, 12) connects *Anemoneae* through *Anemone* § *Pulsatilla* with *Clematideae. Delphineae*, hitherto regarded as a subtribe of *Helleboreae*, is here raised to tribal rank. In a primitive group like the *Ranunculaceae* the remarkably specialised and advanced type of floral structure shown in the zygomorphic flowered *Delphinium* and *Aconitum* should be regarded as a character of primary importance in classification. The seeds, too, are very distinctive in the group.

The most highly specialised types of perianth occur, then, in the genera *Aquilegia, Aconitum* and *Delphinium*, whilst the

* W. C. Worsdell, "The Affinities of Paeonia" in Journ. Bot. 46 : 114–116 (1908); see also the same author on "A Study of the Vascular System in certain Orders of the Ranales" in Ann. Bot. 22 : 663 (1908).

greatest reduction is shown in *Anemone*, *Clematopsis*, *Clematis*, and *Naravelia*, that of the latter two being valvate. Apetaly also occurs in *Enemion* which is clearly a mere reduction from *Isopyrum*.

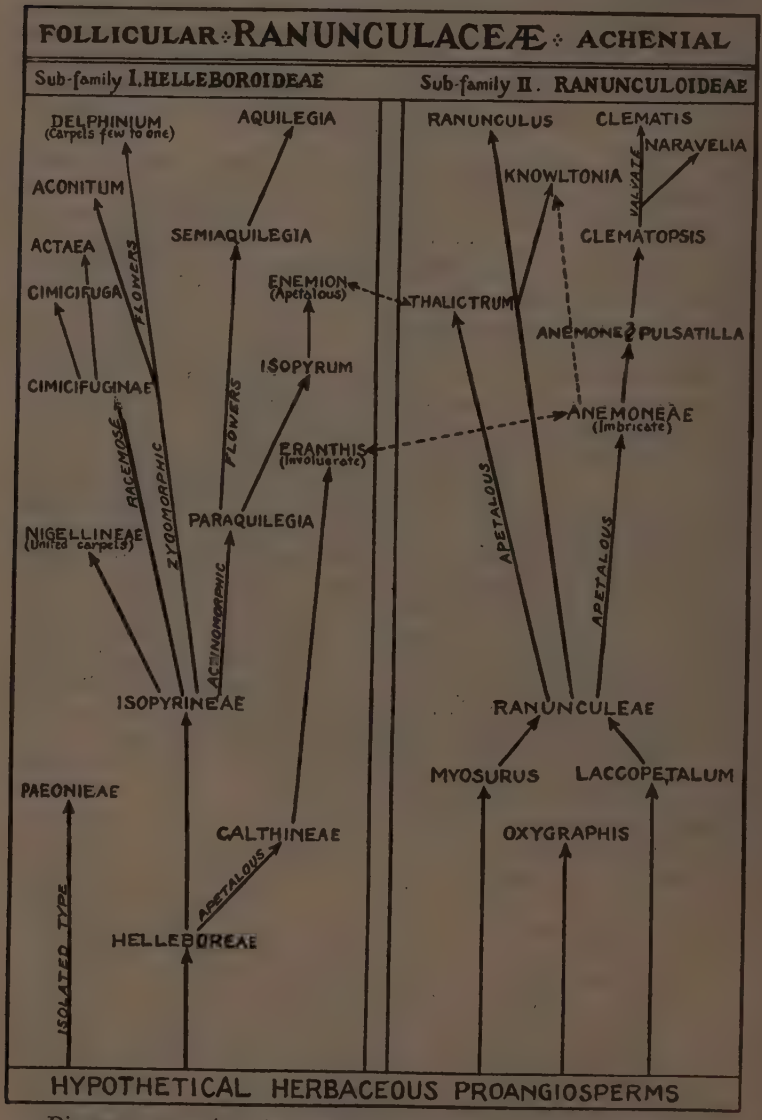

Diagram suggesting the possible course of evolution of the main groups and genera of the family *Ranunculaceae*. The dotted lines indicate genera showing parallel development in the two main groups. The distance from the base line is a rough indication of the relative primitiveness of each group, the basal groups of the *Helleboroideae* being considered more primitive than those of the *Ranunculoideae*.

These genera appear therefore to be amongst the most lately evolved of the *Ranunculaceae*, and they are moreover the most widely spread, the first three terminating a phylum composed of Tribes *Helleboreae* and *Delphineae*, characterised by follicular many-seeded carpels, the others, with a single perianth, ending a second phylum composed of Tribes *Ranunculeae*, *Anemoneae* and *Clematideae*, characterised by achenial 1-seeded carpels. It seems probable that apparent affinity between genera in the two groups is due to parallel evolution. Of the *Helleboreae*, for instance, the small apetalous-flowered genus *Enemion* has sometimes only one seed in its follicular fruit, obviously the result of reduction and it approaches very closely some species of *Thalictrum* of the *Ranunculeae*. Apart from this degraded *Enemion* type of flower, however, the tribe *Helleboreae* appears to have developed very specialised types of inflorescence and flowers and to have produced in one direction the subtribe *Cimicifuginae*, in another the genus *Aquilegia* through *Paraquilegia* and *Semiaquilegia*, whence also the tribe *Delphineae* may also owe its origin, whilst *Ranunculeae* have culminated in the apetalous groups *Anemoneae* and *Clematideae* as already noted.

It should be remarked that coincident with the reduction of one whorl of the perianth we have the singular aggregation of the upper leaves into a protective involucre so marked a feature of tribe *Anemoneae*, as if to compensate for the apetalous condition. Thus the involucre comes to function as an ordinary calyx, and is scarcely distinguishable from such in the genera *Hepatica* and *Barneoudia*. With the assumption of the climbing shrubby habit in *Clematis*, wherein it was no longer required on account of this new mode of growth, the involucre seems to have been dispensed with. Its retention in some of the species of *Clematopsis*, an intermediate genus, is noteworthy.

The elongated carpellary axis of *Myosurus*, recalling as it does the cone-like structure of the more primitive *Magnoliaceae*, must, having regard to the saccate sepals, be looked upon as a primitive feature retained in or perhaps returned to this genus. In another direction, namely, in having broadly-winged seeds contained in two partially connate carpels, the genus *Glaucidium* departs markedly from the usual type of carpellary structure, the general habit of this plant suggesting affinity with *Podophyllum* in the *Berberidaceae*.

Geographical distribution of Ranunculaceae.

Ranunculaceae are to be found in nearly every part of the globe. They are relatively most abundant, both in species and individuals, in the temperate regions of the Northern Hemisphere, and are comparatively rare in the tropics, there found mainly on the mountains and high plateaux.

In Lapland* the family represents about $\frac{1}{2^{1}_{4}}$ of the total phanerogamic vegetation. The most widely spread species in

* Lecoq, Geogr. Bot. 4: 404 (1855).

the family include the following: *Ranunculus aquaticus* (sensu lato), *R. repens*, *R. flammula*, *R. arvensis*, *R. acris*, *R. auricomus*, *R. bulbosus*; *Caltha palustris*; *Hepatica triloba*; *Anemone nemorosa*; *Thalictrum flavum*; *Aquilegia vulgaris*; *Anemone ranunculoides*; *Delphinium consolida*; *Myosurus minimus*. Some species occur only in or near the Arctic Zone or near the snow-line of high mountains; amongst the former are *Caltha natans*, *Coptis trifolia*, *Ranunculus affinis*, *R. lapponicus*, *R. Pallasii*, *R. samojedorum*, *R. sulphureus*. Interesting cases of discontinuous distribution are afforded by *Ranunculus pygmaeus*, in Arctic Europe and in S.E. Tyrol (8,000 ft.), and *R. hyperboreus*, Arctic Europe and in the Himalaya (15,000–17,000 ft.). Some species occur at very high elevations. *Caltha scaposa* grows at 17,000 ft. in Sikkim; *Thalictrum squamiferum* at 15,500 ft. in S.E. Thibet; *Callianthemum pimpinelloides* at 15,000 ft. in Sikkim; *Ranunculus similis* at 17,500 ft. in Thibet.

Those genera with highly specialized flowers such as *Aquilegia*, *Delphinium* and *Aconitum*, are most abundant in the warm temperate regions of the Northern Hemisphere, especially around the shores of the Mediterranean. *Delphinium* alone penetrates into Tropical Africa by way of the high eastern mountains and in the Cameroons.

Map showing the approximate distribution of some genera of RANUNCULACEAE:—

1. PAEONIA. 2. CALTHA § PSYCHROPHILA. 3. SOULIEA. 4. GLAUCIDIUM. 5. HELLEBORUS. 6. COPTIS. 7. TRAUTVETTERIA. 8. HYDRASTIS. 9. CLEMATOPSIS. 10. KNOWLTONIA. 11. HAMADRYAS.

The *Ranunculaceae* of the Southern Hemisphere are rather peculiar, and a study of their structure and affinities suggests that they may be only the remnants of a greater *Ranunculaceous* flora which has almost disappeared. Thus there are remarkably distinct species of *Anemone* in the mountains of South Africa.

Clematopsis occupies the old African plateau and Madgascar, and a peculiar development of *Anemone*, the genus *Knowltonia*, is endemic to the Cape. The dioecious *Hamadryas*, the genus *Barneoudia*, another clear offset of *Anemone*, *Capethia*, and the recently described and evidently primitive genus *Laccopetalum* are confined to the Southern Andes and the extreme southern parts of S. America. The genus *Caltha* is readily split into two groups, both structurally and geographically, § *Populago*, with 15 species in the Northern Hemisphere, and § *Psychrophila* (see map) with 7 species in the Andes of S. America, 2 species in New Zealand, 1 in Tasmania and 1 in South East Australia. Of especial interest is the distribution of the genus *Coptis* (see map), from Eastern China and Japan across the colder parts of North America to the shores of Greenland, and the genus *Paeonia* (see map), which extends from Western Europe eastwards into California, but is entirely absent from Atlantic N. America.

Key to the tribes of Ranunculaceae.

Ovaries with more than 1 ovule; fruits follicular or baccate - Subfamily I. Helleboroideae.
Flowers actinomorphic:
Petals large and showy; carpels surrounded at the base by a fleshy disk - - - - - - I. Paeonieae.
Petals small and narrow or imperfect or absent; no disk - - - - II. Helleboreae.
Flowers zygomorphic; seeds often transversely ridged with scales or winged III. Delphineae.

Ovaries with 1 ovule; fruit a bunch of dry achenes, very rarely baccate
Subfamily II. Ranunculoideae.
Leaves alternate; sepals imbricate
Flowers not subtended by an involucre of leaves; calyx mostly caducous; petals mostly present - - - IV. Ranunculeae.
Flowers subtended by an involucre of leaves remote from the calyx, the latter mostly coloured and persistent at flowering time; petals absent - - - - - V. Anemoneae.
Leaves opposite; sepals induplicate-valvate or rarely partly imbricate; petals absent or represented by outer staminodes - - - - VI. Clematideae.

Key to the Genera.

Tribe I. Paeonieae. Monotypic - - 1. Paeonia.

Tribe II. Helleboreae.
*Flowers solitary, rarely few and subpaniculate, never racemose.

†Leaves palmately nerved or palmately divided - - - - - Subtribe Calthinae.
Petals present, usually much reduced and nectariferous :
Upper leaf-segments not forming an involucre below the flower :
Sepals usually deciduous :
Petals several; leaves not peltate - - - - 2. **Trollius.**
Petals 5, club-shaped; leaves peltate - - - - 3. **Asteropyrum.**
Sepals persistent, broad; petals trumpet-shaped or much reduced - - - - 4. **Helleborus.**
Upper leaf-segments forming an involucre below the flower - 5. **Eranthis.**
Petals absent :
Ovules several, in 2 or more rows; fruits dehiscent :
Seeds not winged; carpels more than 2 :
Ovules arranged all along the ventral suture of the carpel - - - - 6. **Caltha.**
Ovules arranged near the base of the carpel - - 7. **Calthodes.**
Seeds broadly winged; carpels 2 8. **Glaucidium.**
Ovules 2 in each carpel, the latter baccate and becoming connate 9. **Hydrastis.**

††Leaves ternately or somewhat pinnately compound :
‡Carpels quite free from one another Subtribe Isopyrinae.
Staminodes absent :
Petals present :
Sepals and petals numerous; seeds scaly - - - 10. **Anemonopsis.**
Sepals 5–6 :
Carpels more than 2 :
Carpels sessile :
Caespitose perennials; carpels about 5; petals not tubular 11. **Paraquilegia.**
Annuals; carpels about 12; petals tubular 12. **Leptopyrum.**
Carpels stipitate - - 13. **Coptis.**
Carpels 2, divaricate - - 14. **Isopyrum.**
Petals absent - - - - 15. **Enemion.**

Staminodes present within the stamens, flat and membranous; petals saccate or spurred;

Petals saccate at the base - 16. **Semiaquilegia.**

Petals spurred at the base - 17. **Aquilegia.**

‡‡Carpels more or less united, especially in fruit - - - Subtribe NIGELLINAE.

Carpels with long beaks; sepals petaloid, clawed; petals smaller than the sepals - - - - 18. **Nigella.**

Carpels not or scarcely beaked; sepals not clawed:

Sepals coloured and more conspicuous than the petals without transverse markings - 19. **Komaroffia.**

Sepals less conspicuous than the long clawed transversely marked petals - - - 20. **Garidella.**

**Flowers numerous, racemose or racemose-paniculate - - - Subtribe CIMICIFUGINAE.

Leaves orbicular, palmately nerved - 21. **Beesia.**

Leaves much divided:

Stamens more than 10; herbaceous-plants:

Carpels dehiscent:

Inflorescence few-flowered; leaves vaginate - - - 22. **Souliea.**

Inflorescence many-flowered - 23. **Cimicifuga.**

Carpels baccate, solitary - - 24. **Actaea.**

Stamens 5 or 10; carpels dehiscent; a low subshrub - - - 25. **Xanthorrhiza.**

Tribe III. DELPHINEAE.

Posterior sepal spurred at the base - - 26. **Delphinium.**

Posterior sepal hooded at the apex - - 27. **Aconitum.**

Tribe IV. RANUNCULEAE.

Sepals minutely spurred at the base; carpellary axis elongated in the flowering stage; leaves linear - - 28. **Myosurus.**

Sepals not spurred; carpellary axis mainly short or elongated only in fruit:

*Petals present :
Flowers hermaphrodite :
Carpels in several series; stamens usually numerous :
Sepals persistent; petals numerous - - - - 29. **Oxygraphis.**
Sepals caducous or deciduous; petals usually 5 :
Petals with several nectaries on the limb - - - 30. **Laccopetalum.**
Petals with a single (rarely up to 3) nectary at the base or on the claw :
Ovule pendulous; radical leaves much divided - 31. **Callianthemum.**
Ovule ascending; radical leaves usually not much divided - - - 32. **Ranunculus.**
Petals not nectariferous :
Carpels not baccate; style persistent - 33. **Adonis.**
Carpels baccate; style deciduous - - 34. **Knowltonia.**
Carpels in a single series, spreading stellately in fruit; stamens 10 35. **Gampsoceras.**
Flowers dioecious :
Sepals persistent; petals inconspicuous, green; leaves spathulate; Himalaya - 36. **Paroxygraphis.**
Sepals caducous; petals conspicuous; leaves various; extra-trop. S. America - 37. **Hamadryas.**

**Petals absent :
Flowers not solitary or scapose :
Ovule ascending - - - - 38. **Trautvetteria.**
Ovule pendulous - - - - 39. **Thalictrum.**
Flowers solitary on a scape :
Leaves digitately partite; sepals 5; Thibet - - - - 40. **Kingdonia.**
Leaves entire; sepals 10–15; Peru - - - - 41. **Capethia.**

Tribe V. ANEMONEAE.
Involucral leaves numerous, long-stalked; tuberous roots; N. Amer. - - 42. **Syndesmon.**
Involucral leaves mostly 3, sessile or nearly so :
Involucral leaves remote from the calyx and not calycine (*cf.* also No. 34 *Knowltonia*, with baccate fruit and deciduous style) - - 43. **Anemone.**

Involucral leaves close up to the calyx and composed of 3 sepal-like leaves 44. **Hepatica.**
Involucre cyathiform, palmately lobed, close up to the calyx - - - 45. **Barneoudia.**

Tribe VI. Clematideae.
Sepals half imbricate and half induplicate —valvate or wholly imbricate; stems subsimple from a rhizome - 46. **Clematopsis.**
Sepals induplicate-valvate :
Leaves variously compound or entire, none of the leaflets ever tendriliform, the petiole (when habit climbing) sensitive to contact; petals when present clearly staminodal - - - - - - 47. **Clematis.**
Leaves trifoliolate, the terminal leaflet tendriliform and 3-pronged; petals linear or spathulate, sharply differentiated from the stamens - 48. **Naravelia.**

Enumeration of *Ranunculaceae* showing the distribution and type species* of each genus and useful taxonomic literature.† Only those generic synonyms are included which are additional to the Genera Plantarum.

Tribe I.—Paeonieae.

1. **Paeonia** *Linn.*—about 35 species in the North Temperate Zone; absent from Eastern North America; type species *P. officinalis*. For critical determinations of species carried out by Dr. Stapf, see Herb. Kew. For East Asian spp. see Finet & Gagnep. in Bull. Soc. Bot. Fr. 51 : 523–527 (1904).

Tribe II.—Helleboreae.

2. **Trollius** *Linn.*—about 20 species in North Temperate Zone; type species *T. europaeus*, Europe; genus ascends to 11000 ft. in Yunnan (*T. patulus*), to 12000 ft. in Szechuan (*T. ranunculoides*) to 14000 ft. in the N.W. Himalaya (*T. acaulis*) and to 14000 ft. in Sikkim (*T. pumilus*). For East Asian spp. see Finet & Gagnep. in Bull. Soc. Bot. Fr. 51 : 393–396 (1904).
3. **Asteropyrum** *Drumm. et Hutchinson* in *Kew Bull.* 1920 : 155, fig. 1.— —1sp., *A. peltatum*, Western China.

* For rules relating to the selection of type species see Science, n.s., 53 : 312–314 (1921).

† Only such literature as the writer has met with in his work is quoted under each genus; no selection and no attempt at a complete bibliography has been made.

4. **Helleborus** *Linn.*—18 species, mainly South East Europe; type species *H. niger*, S.E. Europe; genus reaches its eastern limit in Thibet with the rare and beautiful *H. thibetanum*.——Revision by Schiffner in Engl. Bot. Jahrb. 11 : 92–122 (1889).
5. **Eranthis** *Salisb.*—7 species, Europe and North Asia; type species *E. hiemalis*, Cent. and S. Europe, Asia Minor.—— Revision by Huth in Engl. Bot. Jahrb. 16 : 293–9 (1892).
6. **Caltha** *Linn.*—about 26 species; N. and S. Temperate and frigid Zones; distinct sections in each hemisphere; type species *C. palustris*; genus ascends to 17000 ft. in Sikkim (*C. scaposa*); section *Psychrophila* confined to Southern Hemisphere.——For East Asian spp. see Finet & Gagnep. in Bull. Soc. Bot. Fr. 51; 388–390 (1904). For section *Psychrophila* see A. W. Hill, "Caltha in the Southern Hemisphere", in Ann. Bot. 32 : 421–435 (1918).
7. **Calthodes** *Hook. f. et Thoms.*—3 species, S.E. Central Asia; type *C. palmata*, Sikkim.
8. **Glaucidium** *Sieb. et Zucc.*—2 species, China and Japan; type species *G. palmatum*, Japan.——See Huth in Engl. Bot. Jahrb. 16 : 290–1 (1892), and Finet & Gagnep. in Bull. Soc. Bot. Fr. 51 : 391–3 (1904).
9. **Hydrastis** *Linn.*—1 species, *H. canadensis*, Atlantic North America.——See Huth in Engl. Bot. Jahrb. 16 : 291–3 (1892).
10. **Anemonopsis** *Sieb. et Zucc.*—1 species, *A. macrophylla*, Japan.
11. **Paraquilegia** *Drumm. et Hutchinson* in *Kew Bull.* 1920 : 156, fig. 2.——4 species, S. Central Asia; type species *P. grandiflora*, N. W. Himal. to W. China.
12. **Leptopyrum** *Reichb.*—1 species, *L. fumarioides*, Cent. and N. E. Asia, naturalised in Europe.——See Drumm. & Hutchinson in *Kew Bull.* 1920 : 159, f. 3.
13. **Coptis** *Salisb.* (incl. *Chrysocoptis* Nutt.).——9 species, N. Hemisphere; type species, *C. trifolia* Salisb., Amur and N. Japan through N. Amer. to Greenland; genus ascends to 12000 ft. in Sikkim (*C. ospriocarpa*). For East Asian species see Finet & Gagnep. in Bull. Soc. Bot. Fr. 51 : 399–402 (1904).
14. **Isopyrum** *Linn.*—12 species, N. Hemisphere except America; type species *I. thalictroides*, French Alps to Poland; genus ascends to 8000 ft. in Sikkim (*I. adiantifolium*). See Drumm. & Hutchinson in *Kew Bull.* 1920 : 161, figs. 5–6.
15. **Enemion** *Raf.*——5 species, E. Asia and N. America; type species *E. biternatum*, Cent. & S. E. North America.—— See Drumm. & Hutchinson in *Kew Bull.* 1920 : 159, fig. 4.
16. **Semiaquilegia** *Makino*, Bot. Mag. Tokyo, 16 : 119 (1902).—— 4 species, China and W. N. America.——type species *S. adoxoides*, China, Corea, Japan.——See Drumm. & Hutchinson in *Kew Bull.* 1920 : 165.

17. **Aquilegia** *Linn.*—about 80 species, N. Hemisphere; species differ slightly and are often little more than local forms; type species *A vulgaris*, Europe.——For East Asian species see Finet & Gagnep. in Bull. Soc. Bot. Fr. 51; 410–414 (1904). N. Amer. spp. E. B. Payson, Contrib. U. S. Nat. Herb. 20 : 133–157, tt. 8–14 (1918).
18. **Nigella** *Linn.*—20 species mainly Mediterranean, type species *N. arvensis*, Europe.
19. **Komaroffia** *O. Kuntze*, in Act. Hort. Petrop. 10 : 144 (1887). ——2 species, *K. integrifolia*, *K. diversifolia*, Afghan. & Turkestan.
20. **Garidella** *Linn.*—2 species, North and Eastern Mediterranean; type species *G. Nigellastrum*, Spain to Caucasus. *G. unguicularis*, Syria & Palest.——Boiss. Fl. Or. 1 : 64 (1869).
21. **Beesia** *Balf. f. et W. W. Sm.* in Notes Roy. Bot. Gard. Edinb. 9 : 63 (1915).——1 species, *B. calthaefolia*, Western China and Thibet.
22. **Souliea** *Franch.* in Journ. de Bot. 12 : 68 (1898).——1 species, *S. vaginata*, Kansu to Yunnan, 9–13000 ft.——See Drumm. & Hutchinson in *Kew Bull.* 1920 : 167. f. 8.
23. **Cimicifuga** *Linn.*—3 species, N. Hemisphere; type species *C. foetida*, Europe to Siberia and Japan.——For East Asian species see Finet & Gagnep. in Bull. Soc. Bot. Fr. 51 : 519–523 (1904).
24. **Actaea** *Linn.*—about 6 species, Temp. N. Hemisphere; type species *A. spicata*, Eur.——See A. Gray Synop. Fl. N. Amer. 1 : I. 55 (1895) and Britton & Br. Fl. Un. St. & Canad. ed. II, 2 : 89 (1913).
25. **Xanthorrhiza** *L'Herit.*—1 species, X. *apiifolium*, Atlantic N. America.——Britt & Br. Fl. Un. St. & Canad. ed. II. 2 : 89 (1913).

Tribe III.—Delphineae.

26. **Delphinium** *Linn.* (incl. *Ceratosanthus* Schur.)——about 230 species, N. Temperate Zone; type species *D. Consolida*, Europe & N. Asia.——For Oriental species see Boiss. Fl. Or. 1 : 72–94 (1867). N. Asian species, Ledeb. Fl. Ross. 1 : 58 (1842). East Asian species, Finet & Gagnep. in Bull. Soc. Bot. Fr. 51 : 461 (1904).
27. **Aconitum** *Linn.*—about 250 species, N. Hemisphere; type species *A. lycoctonum*, N. Europe; for Oriental species see Boiss. Fl. Or. 1 : 94–96 (1867). For Indian species see Stapf, "Aconites of India" in Ann. Calc. Bot. Gard. 10 : 115–197, tt. 92–116 (1905). For East Asian species see Finet & Gagnep. in Bull. Soc. Bot. Fr. 51 : 498–518 (1904).

Tribe IV.—Ranunculeae.

28. **Myosurus** *Linn.*—about 7 species, Cosmopolitan; type species *M. minimus* Eur. to N. Amer. and in Australia.——See revision by Huth in Engl. Bot. Jahrb. 16 : 281–86 (1892).

29. **Oxygraphis** *Bunge.*—3 species, Cent. and N. Asia; type species *O. glacialis*, mountains of Cent. Asia and Western China; genus ascends to 15000 ft. in Himalaya (*O. polypetala*), to 13000 ft. in Szechuan (*O. Delavayi*).

30. **Laccopetalum** *Ulbrich* in Engl. Bot. Jahrb. 37 : 404 (1906). 1 species, *L. giganteum*, Peru.

31. **Callianthemum** *C. A. Mey.*—9 species, S. Europe to N. E. Asia; type species *C. rutaefolium*, S.E. Eur.; genus ascends to 15000 ft. in Sikkim (*C. pimpinelloides*)——Revision by Witasek in Verh. Zool.—Bot. Gesellsch. Wien, 49 : 316–356 (1899).

32. **Ranunculus** *Linn.* (incl. *Beckwithia* Jephson and *Kumlienia* and *Halerpestes* Greene). —— about 300 species; Cosmopolitan; type species *R. auricomus*, widely spread in the N. Hemisphere. A complete revision of the species is a great desideratum.

33. **Adonis** *Linn.*——about 28 species, Temperate N. Hemisphere except America; type species *A. annua* (= *aestivalis* and *autumnalis*, fide Index Kewensis). Genus ascends to 11500 ft. in Yunnan (*A. brevistyla*).

34. **Knowltonia** *Salisb.*——10 species; extra-tropical S. Africa; type species *K. rigida*, Caledon to Uitenhage.——See Huth in Bull. Herb. Boiss. 5 : 423–5 (1896).

35. **Gampsoceras** *Stev.* in Bull. Soc. Mosc. 1852 : 542 t. vii. fig. 6. ——1 species, *G. Pinardi*, Asia Minor.

36. **Paroxygraphis** *W. W. Sm.* in Records Bot. Surv. Ind. 4 : 344 (1913).——1 species, *P. sikkimensis*, Sikkim, 12–14000 ft.

37. **Hamadryas** *Comm.*——5 species in extra-trop. S. America; type species *H. magellanica*, Magellan.——See Huth in Engl. Bot. Jahrb. 16 : 288–290 (1892).

38. **Trautvetteria** *Fisch et Mey.*——2 species, N. E. Asia to N. Amer.; type species *T. carolinensis*, Manchuria to N. America.——See Huth in Engl. Bot. Jahrb. 16 : 286–8 (1892).

39. **Thalictrum** *Linn.* (incl. *Piuttia* Mattei, *Stipularia* Delph. *Leucocoma* and *Sumnera* Nieuwl.).——about 100 species in both hemispheres except Australia, New Zealand, and extra tropical S. America; type species *T. foetidum*. S. Eur.; genus ascends to 15500 ft. in Thibet (*T. squamiferum*).—— Revision by Lecoyer in Bull. Soc. Bot. Belg. 24 : 78-325, pl. 1–4 (1885). East Asian spp. see Finet & Gagnep. Bull. Soc. Bot. Fr. 50 : 604–627 (1903).

40. **Kingdonia** *Balf. f. et W. W. Sm.* in Notes Roy. Bot. Gard. Edinb. 8 : 191 (1914).——1 species, *K. uniflora*, N. W. Yunnan, 13000 ft.

41. **Capethia** *Britton* in Ann. New York Acad. Sci. 6 : 216, 234 (1892).——2 species, W. S. Amer.; type species *C. integrifolia*, Peru to Ecuador.

Tribe V.—ANEMONEAE.

42. **Syndesmon** *Hoffmsegg.* (*Anemonella* Spach.)——1 species *S. thalictroides*, E. N. Amer.——Britton in Ann. New York Acad. Sci. 6 : 237 (1892).
43. **Anemone** *Linn.* (incl. *Pulsatilla** Linn. and *Aiolon* Lunell).——about 180 species, Cosmopolitan; type species *A. coronaria*, Eur. to N. Asia. See E. Ulbrich, "Über die systematische Gliederung geographische Verbreitung der Gattung *Anemone* L." in Engl. Bot. Jahrb. 37 : 172–334 (1906) For East Asian spp. see Finet & Gagnep. in Bull. Soc. Bot. Fr. 51 : 56–76 (1904). See N. L. Britton, "The American species of the Genus *Anemone* and the Genera which have been referred to it", in Ann. N. York Acad. Sci. 6 : 215–238 (1892).
44. **Hepatica** *Dill.* ex *Linn.*——4 species, N. Temperate Zone; type species, *H. triloba*, Scandinavia to Pyrenees and across Asia to Canada.——For Amer. species see Britton in Ann. New York Acad. Sci. 6 : 233 (1892).
45. **Barneoudia** *Gay.*——4 species, Chili, Argentine; type species *B. chilensis*, Chili.——Britton in New York Acad. Sci. 6 : 235 (1892).

Tribe VI.—CLEMATIDEAE.

46. **Clematopsis** *Bojer* ex *Hutchinson* in Kew. Bull. 1920 : 12, figs. 1–5.——15 species, Trop. & S. Afr., Madag.; type species *C. pimpinellifolia*, Madag.
47. **Clematis** *Linn.*——230 species, mostly Temperate Regions, rare in Tropics; type species *C. Vitalba*, Europe.——Revision by O. Kuntze, "Monogr. der Gattung Cl." 1885. See Boiss. Fl. Or. 1 : (1867). Hook. f. Fl. Brit. Ind. 1 : 2. For East Asian species see Finet & Gagnep. in Bull. Soc. Bot. Fr. 50 : 518–557 (1903). Cheeseman, Fl. New Zeal. 1 (1906). See also Gray, Synop. Fl. N. Amer. 1 : 4 (1895).
48. **Naravelia** *Linn.*——7 species, Indo-Malaya, South China; type *N. laurifolia*, Burma to Philippines.——Ridley, Fl. Mal. Penins. 1 : 2 (1922).

Doubtful genus—*Bodinieria* Léveille & Vaniot in Bull. Acad. Geogr. Bot. 1902, 48; not found in Léveille's herbarium, now at Edinburgh Botanic Garden.

VI.—NEOHOUZEAUA, A NEW GENUS OF BAMBOOS.

J. S. GAMBLE.

My attention was recently drawn by Mr. R. S. Hole, C.I.E., Forest Botanist at the Forest Research Institute at Dehra Dun, India, to a new genus of bamboo published by Mlle. A. Camus,

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* *See* p. 72.

in the Bulletin of the Musée National d'Histoire Naturelle, at Paris, for 1922, page 100, with the suggestion that a Burmese bamboo of which he was sending good and complete specimens and hitherto known as *Teinostachyum Helferi*, might belong to it.

The genus *Teinostachyum* was first established by Genl. William Munro, C.B., in his 'Monograph of the Bambusaceae.' Trans. Linn. Soc. Vol. xxvi (1868) to contain two species (1) *T. Griffithii* of Assam and Burma and (2) *T. attenuatum* of Ceylon, and a third was added later by Col. R. H. Beddome in his 'Flora Sylvatica' of S. India and Ceylon, viz.: *T. Wightii*, of the mountains of S. India. The chief characters of the genus were :—"Spikelets in bracteate whorls, long, many-flowered, glumes mucronate, palea convolute, stamens with free filaments, ovary long-beaked."

When writing the "Bambuseæ of British India,' Vol. vii, of the 'Annals of the Royal Botanic Garden, Calcutta,' I added to the other three two more which were imperfectly known. They were fairly well represented in Herbaria as regards leaves, etc., but good flower spikelets were not then available These two species were *T. Dullooa*, a widespread bamboo of the Eastern Himalaya, Assam, Chittagong and Burma, and *T. Helferi*, of the hills of Assam and Burma, originally described by Munro as *Bambusa Helferi* and transferred by Kurz to *Pseudostachyum*, a genus which I thought it very unlikely to belong to.

A few years ago, I received good specimens of *T. Dullooa*, collected at Mogaung, in Burma, by Mr. H. N. Thompson, Deputy Conservator of Forests, in March, 1896, and recognised that the structure of the flowers, with only one flower in each spikelet and monadelphous stamens, would not do for *Teinostachyum*, but I was too busy with other work to do more with the question either then or in 1921, when Mr. Hole sent me flowers from Sibsagar, in Assam, so I am glad to find that Mlle. A. Camus has taken the matter up and has described her own genus to contain two species, one from China, *N. Mekongensis*, and the other my *T. Dullooa*, whose range she extends to Tonkin, whence the Paris Herbarium had received specimens collected by Mons. Balansa. Indeed, it goes further than Tonkin, for I feel pretty sure that Dr. E. D. Merrill's No. 8246, collected in Mindanao, in the Philippines, leaf and sheath specimens only, is in all probability the same species.

Mlle. A. Camus' description of the genus *Neohouzeaua* is as follows :—

"*Panicula* elongata, ramosa, densa. *Spiculae* fertiles 1-florae; glumae steriles 3–4, mucronatae, saepe gemmiparae; gluma fertilis involuta, mucronata, subaristata; palea involuta, elongata, ecarinata, apice bicuspidata. *Glandulae* o vel parvulae. *Stamina* 6; filamenta connata; antherae apice obtusae. *Ovarium* oblongum; stylus rigidus, crassiusculus, elongatus; stigmata 3, exserta. *Fructus* . . ."

It seems to me that the only point in which this new genus differs from *Schizostachyum* as originally described is that the stamens are monadelphous instead of free.

As this character is considered sufficient to separate *Gigantochloa* from *Bambusa*, there is no reason why it should not be sufficient to separate *Neohouzeaua* from *Schizostachyum*, and perhaps some species described under the latter may also have to be transferred to the former. As a rough working key to the two genera and their neighbours, I suggest :—

Palea 2-keeled, two keels close together - *Cephalostachyum.*
Palea convolute, not keeled :—
Spikelets with several flowers - - - *Teinostachyum.*
Spikelets 1-flowered :—
Stamens monadelphous - - - *Neohouzeaua.*
Stamens free - - - - *Schizostachyum.*

The description of the flowers of *N. Dullooa*, which may be added to those given in the ' Bambuseæ ' at p. 101, and in the ' Flora of British India,' Vol. vii., p. 411, is as follows :—

" Spikelets usually 2 together, slender, bracteate at the base; empty glumes 2–4, small, mucronate; flowering glume oblong-lanceolate, mucronate, strigosely hirsute, 5–6 in. long, about 8–10 nerved; palea convolute, glabrous except near the apex, ·7–·8 in. long, biaristate, the base sometimes with a free terminal rachilla often bearing rudiments of a terminal flower; stamens 6, monadelphous, the anthers ·35 in. long, obtuse at apex, at length exsert; ovary elongate, glabrous, stigmas 3, short, red."

I now come to the question of *Teinostachyum Helferi*, of which Mr. Hole has sent me a number of excellent specimens in all stages. The spikelets are much larger than those of *N. Dullooa* and are 1–1·5 in. long, the palea is convolute with no trace of keels and biaristate, the stamens are monadelphous, so that it clearly must now be transferred to *Neohouzeaua* and be known as *N. Helferi* Gamble n. comb. The following description may be added to those given in the ' Bambuseae ' and the ' Flora of British India.'

" Heads of spikelets often large, even up to 2 in. in diam., though usually less. Spikelets usually 2 together, slender, prominently bracteate at the base; empty glumes usually 2, small, ·2 and ·3 in. long, mucronate, the margins slightly strigosely hirsute; flowering glume ovate-lanceolate, long-mucronate, strigosely hirsute, ·5–1 in. long, many-nerved; palea convolute, glabrous except at the tip, 1·25–1·5 in. long, biaristate, the base sometimes with a free terminal rachilla; stamens 6, monadelphous, the anthers ·5–·75 in. long, obtuse at apex, at length exsert; ovary oblong, elongate, glabrous, stigmas 3, short, red; pericarp of caryopsis leathery, oblong, including the beak over 2 in. long.

The leaves, as shown by the fine specimens collected by Mr. K. F. R. Dickins and others in the Thandaung forests of the

Toungoo District, and sent by Mr. Hole, are very large, and may reach 24 in. in length and 5 in. in breadth, and end in a long and slender hispid acumination. Mr. Dickins' description is worth quoting. He says : " Wathabut is of evergreen caespitose type, tufted, semi-scandent, straggling and drooping, forming a thicket. Height 15–40 ft., more if the culms were erect. Internodal distance 18–24 in. and over (the specimens sent by Mr. Hole had the distance 32 inches, and two culms were 1–4 in. in diam.). Occurs at elevations of 3,000–4,000 ft. with a rainfall of over 200 in. a year. Appears to be flowering gregariously this year (1922). The culms are used for house-building and baskets, and owing to its thin walls, its pliability and the length between nodes is a useful species."

I now come to a third species, which I think belongs to the same genus, as it has the spikelets in pairs, 1-flowered, a convolute palea, biaristate at tip, and monadelphous stamens. It was collected in 1919 in Tavoy by Mr. C. Gilbert Rogers, C.I.E., then Chief Conservator of Forests in Burma, who describes it as " a small erect bamboo with culms from 10 to 15 ft. high, solid at base, about 2 in. in girth, and having the internodes of an average of 14–15 inches." It has the curious character of possessing on the lower side at the top of the leaf-sheath, a triangular horn-like appendage to the callus. I propose to call it *N. tavoyana*, and append a description of it.

Neohouzeaua tavoyana Gamble n. sp. Erectus, culmis 3–4·5 m. altis, circiter 1·5 cm. diametro, prope basim solidis. *Folia* oblonga, apice longe setaceo-acuminata, basi subobtusa, glabra, 25–35 cm. longa, 3–6 cm. lata, nervis primariis utrinque 6–10; petiolus crassus, planus, 1 cm. longus; vaginae glabrae teretes, sub petiolo productae et ad latus inferius callo triangulari cornuto munitae; ligulae productae, 3–4 mm. longae, apice lacerae. *Spiculae* binae in capitulis ad nodos paniculae terminalis aggregatae; capitulae inferiores sub-globosae, multispiculatae, 2–3 cm. diametro, superiores gradatim minores, ultimae 1–2 spiculas vel nullas gerentes; spiculae uniflorae, angustae, 2–2·5 cm. longae, basi bracteis multis suffultae et glumis vacuis mucronatis 2–3 ad basim munitae. *Gluma* florens ovato-oblonga, apice longiuscule aristata, dorso subglabra vel paullo hirsuta, 1–1·2 cm. longa, margine minute ciliato-scabra; palea angustissima multum convoluta, apice biaristata, 2–2·5 cm. longa. *Stamina* 6, monadelpha, antheris gracilibus, circiter 1 cm. longis, apice subobtusis. *Lodiculae* nullae vel 2 brevissimae. *Ovarium* longissimum, stigmatibus rubris. *Caryopsis* nondum visus.

Burma. Sinyat hill in Tavoy at 300 m. alt. *C. G. Rogers*, Jan. 1919. No. 361 T.

In the size of the spikelet and, indeed, also, in the size of the leaves, this species is intermediate between. *N. Dullooa* and *N. Helferi*. It may be hoped that one of Mr. Rogers' successors will be able to ascertain more about it and send the culm-sheaths which have not yet been collected.

Neohouzeaua tavoyana.

Neohouzeaua Helferi.

Neohouzeaua Dullooa.

GA.

VII.—MISCELLANEOUS NOTES.

Captain W. B. Dowson, B.Sc. (Agric.), has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Superintendent, Agricultural Department, Nigeria.

Mr. H. Nicholas, Dip. Agric., has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Assistant Superintendent, Agricultural Department, Gold Coast.

Mr. F. S. Lyne, late Superintendent of the Accra Sisal Plantation, Gold Coast, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Director of Agriculture, Seychelles.

Richard Arnold Dummer.—We regret to learn of the death, through a motor accident in Uganda, of R. A. Dummer, who was a student gardener at Kew from May, 1910, to June, 1911, having previously worked in the Municipal Gardens, Cape Town. After leaving Kew he assisted in the preparation of Elwes and Henry's "Trees of Great Britain," but at the same time was able to prepare several papers, which were published in the Journal of Botany. His "Enumeration of the Bruniaceae" formed Supplement II. to the volume for 1912, and in the same year he described *Pearsonia*, a new genus of *Leguminosae*, containing eleven species. He contributed notes on various South African plants to the Journal of Botany during 1913 and 1914 and the *Kew Bulletin* in 1912. In 1914 he obtained an appointment with the Kivuvu Rubber Company, Uganda, and, with the exception of a short stay in Cape Town, had resided in Uganda ever since. He made numerous collections, including many Fungi, in Uganda and Kenya Colony, and a letter from him announcing the despatch of further specimens arrived the day after the receipt of the news of his death.

Uses for Cedar Wood.—Advice is often sought as to a market for the wood of the Lebanon cedar (*Cedrus Libani*), as after the fall of a large specimen the owner has great difficulty in disposing of it even at the price of firewood. The wood grown in this country is coarse in texture, but it is infinitely superior to coarse wood of silver fir, yet after a trunk or two have been purchased by a timber merchant they often lie on his hands for years without finding a purchaser. If, however, the owners of estates who have cedar wood for disposal would have it cut up into suitable sizes they would find it very useful for estate purposes. In some places it has been used for rafters, doors, mangers and racks in farm buildings with great success, whilst it has been found to make very good fencing, and excellent troughs and racks for the outdoor feeding of cattle, the wood being more durable than that of other kinds sometimes used for the purpose. The cleanest wood is very useful for linings of drawers and chests where

clothing is stored, the fragrance being a deterrent to insects. Furniture is sometimes manufactured from the wood, whilst it can also be used for panelling. Lack of a regular supply of the timber is probably the reason for the poor price realised, and with this and other woods that only appear upon the market as isolated examples the owner would often be well advised to have them cut up and worked for private purposes.—W.D.

Poplars for Farm Land.—Although badly placed trees interfere a good deal with the proper use of agricultural land there are positions on most large farms where trees may be grown with advantage to the farmer either in the provision of shelter, shade for stock, or the cropping of land unsuitable for agriculture. In some places such land may be narrow copses or spinneys two or three acres in extent, in others there may only be space for a few trees, whilst elsewhere isolated trees may be needed along boundaries or water-courses. Wherever trees are needed, however, a species suitable for the position should be chosen and one that may be calculated to bring in revenue at some future date. Too often the trees planted in such places are mixed lots left in nurseries after the end of the planting season, whereas they should be as carefully chosen as trees for planting over extensive areas. Where land is moist but not waterlogged, poplars are satisfactory trees to plant. They are hardy, grow rapidly, and under ordinary conditions bring in a satisfactory return at the end of 50 years. They may even be induced to grow on waterlogged land by opening deep drains and planting cuttings or young trees on mounds two to three feet above the ordinary level. Moreover they are peculiarly suitable for small groups, narrow plantations and isolated trees near water, as they need to develop good heads of branches to insure satisfactory trunk increment. It is better to plant one kind than a mixture, and either one of the following may be chosen: *Populus serotina*, *P. Eugenii*, *P. trichocarpa*, *P. robusta*. *P. Eugenii* and *P. robusta* form much narrower heads than the other two, therefore they shade less of the surrounding land and are less liable to wind injury than the others. Cuttings one to three feet long may be inserted in the places the trees are to occupy, or cuttings a foot long may be raised in a garden and the young trees be planted out at the end of the first or second year. They must be protected from stock and vermin for a few years, the only other attention needed being the occasional removal of lower branches and keeping the trunks to a single leader.—W.D.

Index Kewensis.—The task of compiling the quinquennial supplements of this work is steadily growing every year owing to the increasing amount of literature that has to be examined for the extraction of names. To add to the difficulties that have been encountered in recording synonymy generally, a practice has grown up of authors indicating after the specific name only

the name of the author who had originally used part of the combination, no reference being given to the work in which the original combination occurred, or indication that the combination was being used for the first time. In such cases the compiler of the Index has the very considerable task of searching the works of the original author until a name is found from which the new combination may have been derived. Thus the combination *Genus B species a* (Author A) Author B, will entail searching through the whole of Author A's works until an allied species with the trivial *species a* is found and even then there is nothing definite to show that *Genus A species a* Author A was the original.

It would be of the greatest assistance if authors would indicate the first time a new group or combination is used by adding the sign "n.sp." or "comb. nov.," and also cite the synonyms on which they are based.

The Index Kewensis is so greatly appreciated that it is felt that these difficulties need only be pointed out for all to assist in lightening the compiler's task.

Gold Coast Forest Officers' Handbook.* — In this useful handbook Major Chipp has brought together a mass of first-hand information on West African Forestry, especially on the forests of the Gold Coast, Ashanti, and the Northern Territories where the author was, until lately, Deputy Conservator of Forests.

Since Mr. H. N. Thompson made his preliminary survey of the Gold Coast in 1908, great progress has evidently been made in this important West African colony. In the attractive handbook before us we learn much about the natural features of the country, the climate and its relation to forest distribution, besides a history of the Forest Department. Lists of native and botanical names of trees and other plants of economic importance are given, and at the end of the book are reproduced the twenty drawings of the more useful trees which appeared in Mr. Thompson's report. Especially useful to even casual visitors to the colony will be the notes on the every-day life of the West Coast, and the outfit required by the European. The book is well printed and illustrated by several maps and diagrams.—J.H.

Chinese Botany.—Two papers on Chinese botany appeared last year in the Journal of the North China branch of the Royal Asiatic Society. The first (vol. liii., 158–188) is a list of the plants of Peitaiko by Mr. N. H. Cowdry, the second a "Liste des Essences ligneuses observées dans le Honan Septentrional," by Mr. J. Hers. Both give the Chinese equivalents of the species mentioned. We are glad to welcome these and other signs of botanical activity among foreign and native residents in China.—S.T.D.

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* T. F. Chipp, The Forest Officers' Handbook of the Gold Coast, Ashanti and the Northern Territories, pp. 149, tt. i.–xx., with maps and diagrams. Published for the Government of the Gold Coast by the Crown Agents for the Colonies, 4, Millbank, London, S.W. 1.

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PLATE I.

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